

New Species of *Cassis* (Cassidae) from the Caloosahatchee Formation of Southern Florida

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ABSTRACT Two new fossil Helmet Shells of the genus *Cassis* Scopoli, 1777, are described from the Early Pleistocene (Gelasian Age) Caloosahatchee Formation of southern Florida. The two new species include *Cassis calusa* n. sp. (restricted to the Fort Denaud Member, early Gelasian Age) and *Cassis powelli* n. sp. (restricted to the Ayers Landing Member, late Gelasian Age) and these are ancestral to both the Calabrian Pleistocene *Cassis schnireli* Petuch, 1994 (Holey Land Member, Bermont Formation) and the living Carolinian Province *Cassis spinella* Clench, 1944. The two new Helmet Shells represent the seventh and eighth species of *Cassis* known from the Florida fossil record.

KEY WORDS *Cassis*, *C. calusa*, *C. powelli*, Cassidae, Caloosahatchee Formation, Fort Denaud Member, Ayers Landing Member, Florida, Pleistocene Epoch, Gelasian Age, Palm Beach County

INTRODUCTION

Helmet Shells of the genus *Cassis* are very rare in the worldwide fossil record, with only around 20 species known to date. The genus has never been very species-rich, with only six living species of *Cassis* (*sensu stricto*) known from the Holocene worldwide tropical seas. An additional seven other smaller cassids in the closely-related subgenus *Hypocassis* are also known from West Africa, the Indian Ocean, and the Australian Region, bringing the total number of living *Cassis* (*sensu lato*) species to thirteen. In Florida, four living species and six fossil species are known, and these include: (living) *Cassis madagascariensis* (Lamarck, 1822), *Cassis tuberosa* (Linnaeus, 1758), and *Cassis flammea* (Linnaeus, 1758) (all wide-ranging Caribbean Province species that extend into southern Florida), and *Cassis spinella* Clench, 1944 (endemic to the Carolinian Province; see Petuch, 2013); and (fossil) *Cassis*

delta Parker, 1948 (Chipola Formation, Burdigalian Miocene), *Cassis flintensis* Mansfield, 1940 (Flint River and Suwannee Formations, Rupelian Oligocene), *Cassis floridensis* Tucker and Wilson, 1932, (Pinecrest Member, Tamiami Formation, Piacenzian Pliocene), *Cassis ketteri* Parodiz and Tripp, 1992 (Fruitville Member, Tamiami Formation, late Piacenzian Pliocene), *Cassis schnireli* Petuch, 1994 (Holey Land Member, Bermont Formation, Calabrian Pleistocene), and *Cassis jameshoubrieki* Petuch, 2004 (Holey Land Member, Bermont Formation, Calabrian Pleistocene; ancestral to *C. tuberosa*) (for the systematics and biogeography of the fossil and living species, see Petuch, 1994, 2004, and 2013; for southern Floridian geology and stratigraphy, see Petuch and Roberts, 2007).

One of the most obvious voids in the molluscan biostratigraphic record of southern Florida was the absence of any *Cassis* species from the early

Pleistocene (Gelasian Age) Caloosahatchee Formation. This fossil-rich formation underlies the entire Everglades region and has been collected extensively over the past four decades, but had never yielded any *Cassis* species. This was always considered to be a problematical situation, as the underlying (directly subjacent) Tamiami Formation contains two described species and the overlying (directly suprajacent) contains an additional two described species. The absence of the genus from the Caloosahatchee Formation was considered to be an artifact of paleoecology and depositional environments, as most of the formation was deposited in very shallow, often intertidal, environments, places where large *Cassis* species would not occur. Finally, in 2011, during extensive canal excavations in the Everglades Agricultural Area of western Palm Beach County, two new species of *Cassis* were discovered in exposed Caloosahatchee beds, one from the lower Fort Denaud Member (early Gelasian Age) and one from the upper Ayers Landing Member (late Gelasian Age). Paleoecological analyses of these Caloosahatchee beds indicated that they represented a deeper water facies, probably around 10 m depth, and contained numerous broken fossil echinoids, the preferred food resource of *Cassis*. These two important additions to the Florida fossil record are described here. The holotypes are deposited in the type collection of the Paleontological Research Foundation, Ithaca, New York (an affiliate of Cornell University), and bear PRI catalog numbers.

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SYSTEMATICS

Class Gastropoda

Subclass Sorbeoconcha

Order Prosobranchia

Infraorder Mesogastropoda

Superfamily Tonnoidea

Family Cassidae

Genus *Cassis* Scopoli, 1777

Cassis calusa Petuch and Berschauer,
new species
(Figure 1A, B)

Description. Shell of typical size for genus, averaging around 145 mm in length, inflated and barrel-shaped, distinctly triangular, with sharply angled shoulder; spire whorls low, subpyramidal, sloping posteriorly; shoulder ornamented with 18-20 small pointed knobs; body whorl sculptured with 16-18 narrow, evenly-spaced prominent cords, with cords being slightly beaded and undulating; fourth cord from posterior end of body whorl larger than others, ornamented with large, low beads; siphonal canal recurved dorsally; parietal shield broken on type lot specimens, presumed to be rounded in shape; aperture proportionally narrow, widening rapidly toward anterior end; inside edge of outer lip ornamented with 10-11 large, narrow, widely-separated teeth, with the central 3 or 4 teeth being wider and bifurcated; columellar area of parietal shield ornamented with 35-45 closely-packed, thin elongated teeth; spire whorls ornamented with numerous closely-packed, thin radiating riblets, becoming larger and more prominent along spire whorl sutures; radiating spire whorl riblets crossed by 3-4 large spiral cords; intersection of radiating riblets and spiral cords producing prominent elongated beads.

Type Material. HOLOTYPE: length 152.8 mm, width 104.7 mm, collected in an excavation along the Miami Canal, 20 m south of Lake

Harbor, Palm Beach County, Florida, PRI 13344; OTHER MATERIAL EXAMINED: length 145 mm, width 90 mm, collected in a road fill excavation at the Okeelanta Sugar Cane farm, 7 km west of the Miami Canal, Palm Beach County, Florida, in the research collection of the senior author; length 144 mm, width 86 mm, from the same locality as the holotype, in the collection of Larry and Judy Haley, West Palm Beach, Florida.

Type Locality. Collected in a de-watered spur canal off the eastern side of the Miami Canal, at the border of the old Talisman Sugar Cane farm and the Holey Land Wildlife Management Area, 20 km south of Lake Harbor, Palm Beach County, Florida. The holotype was found in a depression in the canal wall, at around 6 m below the surface, in the lowest exposed bed of the Caloosahatchee Formation.

Stratigraphic Range. The new species is confined to the Fort Denaud Member of the Caloosahatchee Formation, early Gelasian Age of the Early Pleistocene, and has only been found in the area of the Miami Canal in western Palm Beach County.

Paleoecology. Based on associated fossils, the new cassid preferred sand and coral rubble sea floors in around 10 m depth. Broken echinoid tests and spines were abundant at the type locality, as were the small cassid *Phalium alligator* Petuch, 1994, the olivid *Americoliva erici* (Petuch, 1994), and the conid *Kohniconus susankhane* (Petuch, 1994).

Etymology. Named for the Calusa Indians, the original inhabitants of the southern Everglades and Florida Keys areas.

Discussion. With its distinctly triangular shape, subpyramidal spire, and row of numerous small knobs around the shoulder, *Cassis calusa*

closely resembles the living *C. spinella* Clench, 1944 from the Carolinian Province (North Carolina, the Florida Keys, and the entire Gulf of Mexico), but differs in being a smaller and more elongated shell with a higher spire, and in being a much more ornate shell, with stronger and more pronounced spiral cords on the body whorl and spire. The new species is also ancestral to the younger Bermont Formation *Cassis schnireli* Petuch, 1994 (Calabrian Age of the Middle Pleistocene), but differs in being a much more triangular shell with smaller and more numerous knobs along the shoulder. The larger Bermont species also lacks the strong, narrow, raised spiral cords seen on *C. calusa* and has, instead, two rows of large knobs encircling the body whorl.

Cassis powelli Petuch and Berschauer,
new species
(Figure 1C, D)

Description. Shell of typical size for genus, averaging 150 mm in length, broadly triangular in outline, inflated, barrel-shaped, with high subpyramidal spire; spire whorls sloping; shoulder sharply angled, ornamented with 12-15 small rounded knobs; body whorl ornamented with 12-15 large, wide, evenly-spaced prominent spiral cords; 2 mid-body cords (third and fifth on holotype) being larger and wider than others and being ornamented with 10-12 large knobs; siphonal canal recurved dorsally; parietal shield wide, rounded in outline; aperture proportionally narrow, widening toward anterior end; inside edge of lip ornamented with 11-12 large, narrow teeth, with central 3 or 4 teeth being wider and bifurcated; columellar area of parietal shield ornamented with 35-45 thin, closely-packed elongated teeth; spire whorls ornamented with numerous strong, elongated beads and riblets, arranged in distinct radiating pattern; spire riblets overlaid with 4-5

raised spiral cords, with intersection of cord and riblet producing a distinct elongated bead.

Type Material. HOLOTYPE: Length 108.5 mm, width 74.8 mm, from Ayers Landing exposures in the Griffin Brothers Pit, Holey Land Area, Palm Beach County, Florida, PRI 33143; OTHER MATERIAL EXAMINED: length 190 mm, width 135 mm, same locality and stratigraphic unit as the holotype, in the research collection of the senior author.

Type Locality. The new species was collected in the Griffin Brothers Pit, along the eastern boundary of the Holey Land Wildlife Management Area, approximately 38 km south of South Bay, Palm Beach County, Florida. The holotype was found in a large mass of the Ayers Landing, brought up in a dragline from 7 m depth in the largest flooded pit. Other classic Ayers Landing gastropods were also found along with the holotype, including the turbinellid *Hystrivasum griffini* Petuch, 1994, the cypraeid *Siphocypraea griffini* Petuch, 1991, the olivid *Americoliva jenniferae* (Petuch, 1994), and the sinistral conid *Contraconus heilprini* Petuch, 1994.

Stratigraphic Range. The new species is confined to the Ayers Landing Member of the Caloosahatchee Formation, late Gelasian Age of the Early Pleistocene. To date, *Cassis powelli* has only been collected at the type locality.

Paleoecology. The holotype was found in a fine grained unconsolidated calcarenite that contained abundant sea urchin spines and pieces of broken echinoid tests. Based upon the inclusion of abundant small *Chione* clams within these sediments, the new species probably lived on open sea floors composed of clean carbonate sand near large Turtle Grass (*Thalassia*) beds, in depths of 2-5 m.

Etymology. The new taxon honors Charles L. Powell, II, of San Jose, California, stratigraphic geologist and paleontologist with the United States Geological Survey, in recognition of his many important contributions to the molluscan paleontology of California.

Discussion. Of the known fossil cassids of Florida, *Cassis powelli* is most similar to *C. schnireli* Petuch, 1994 from the Calabrian Pleistocene Bermont Formation, especially in having an inflated, barrel-shaped shell and high spire. The new Caloosahatchee species differs from its younger Bermont descendant, however, in being a more heavily ornamented shell, having numerous large, highly-raised, strong cords on both the body whorl and spire whorls. The knobs on the shoulder and body whorl cords of *C. powelli* are also proportionally larger, more pointed, and more numerous than those on the younger *C. schnireli*. The spire whorls of the Bermont *C. schnireli* are also more domed, with a rounded profile, while the spire whorls of the Caloosahatchee *C. powelli* are more planar and acute.

The discovery of *Cassis calusa* and *Cassis powelli* completes the stratigraphic sequence for the *Cassis spinella*-type Helmet Shell lineage of the Floridian Plio-Pleistocene and Holocene. This evolutionary sequence is as follows (oldest to youngest):

Cassis floridensis (mid-Piacenzian Pliocene) --
Cassis ketteri (late Piacenzian Pliocene) --
Cassis calusa (early Gelasian Pleistocene) --
Cassis powelli (late Gelasian Pleistocene) --
Cassis schnireli (Calabrian Pleistocene) --
Cassis spinella (Ionian and Tarantian Pleistocene and Holocene).

This lineage, which is typified by having very numerous small knobs along the shoulder, is now known to be a separate Helmet Shell evolutionary line that is endemic to Florida and

the Southeastern United States, and is not closely related to the Caribbean *Cassis madagascariensis*.

ACKNOWLEDGMENTS

The authors thank the following individuals: Larry and Judy Haley, who collected the first specimens of *Cassis calusa* along the Miami Canal; Howard ("Andy") Griffin, owner of the Griffin Brothers Pit, who allowed the senior author to conduct field work in his quarries for over 15 years; Brian Schnirel, West Palm Beach, Florida, who assisted the senior author with collecting at several important research sites; Florida Crystals, Inc. Sugar Company, for allowing the senior author to collect on their properties along the Miami Canal.

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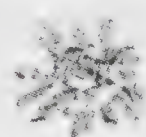
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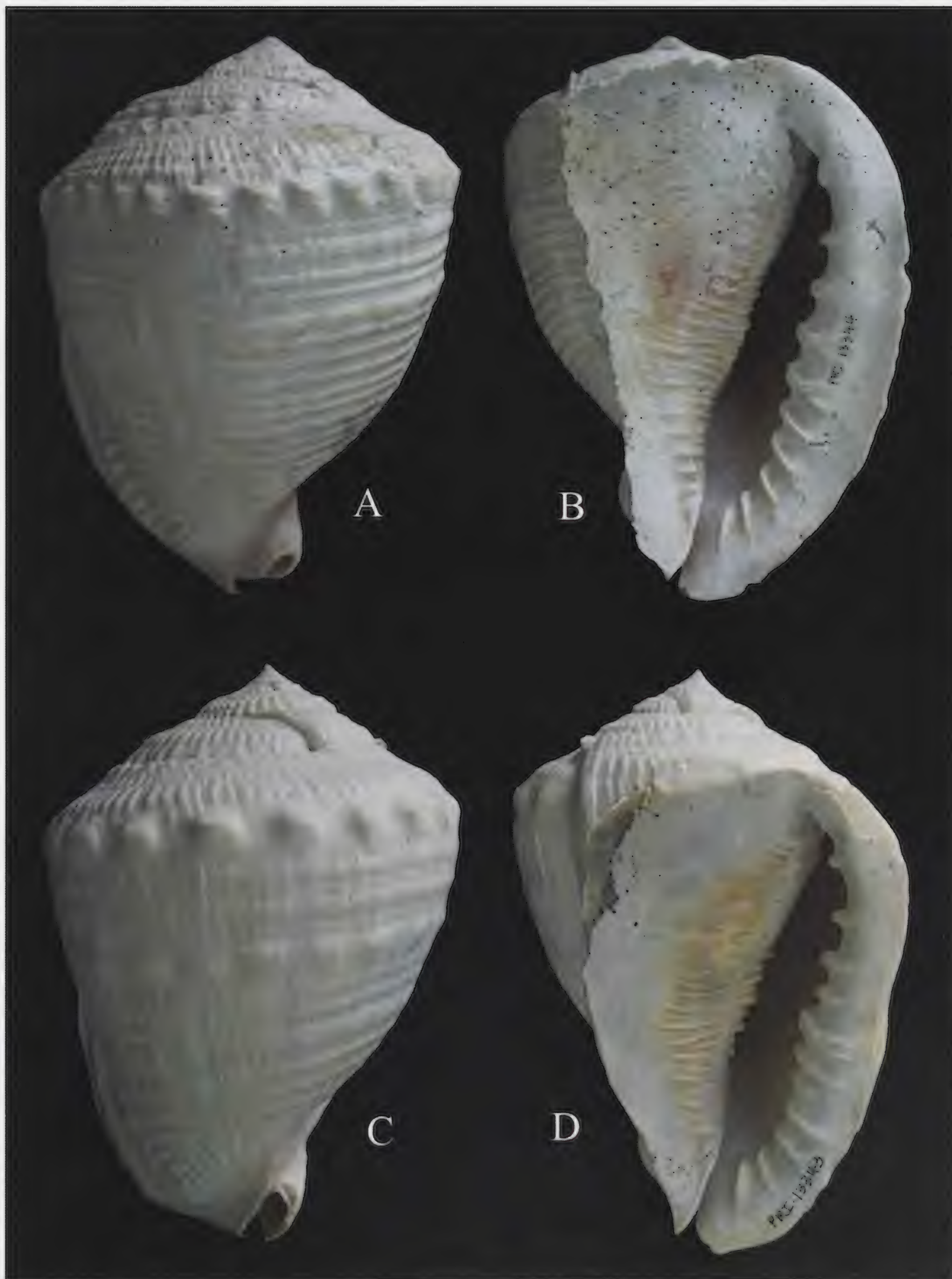


Figure 1. New Species of *Cassis* from the Caloosahatchee Formation of Southern Florida. A, B = *Cassis calusa* Petuch and Berschauer, new species, Holotype, 152.8 mm in length; C, D = *Cassis powelli* Petuch and Berschauer, new species, Holotype, 108.5 mm in length.